

The [CII] and [OI] emission lines

in NGC1313 and NGC6946

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OUTLINES

- Origin of the FIR emission lines
- NGC1313 and NGC6946
- Observations
- Results:
 - Comparison with the ISO-KP sample
 - Comparison with other gas component (CO,HI)
 - Comparison with the models
- Conclusions

Origin of the [CII] (158 μm)

and [OI] (63 μm) emission lines

- [CII] 158 μm

Ionisation C potential: 11.3 ev:

C⁺ mainly outside HII regions

magnetic dipole transition (${}^2\text{P}_{3/2} \rightarrow {}^2\text{P}_{1/2}$) of the C⁺ at T=91 K and $n_{\text{CII}}^{\text{crit}} \simeq 3 \times 10^3 \text{ cm}^{-3}$

- [OI] 63 μm

magnetic dipole transition (${}^3\text{P}_1 \rightarrow {}^3\text{P}_2$) of the OI atom at T=228 K and $n_{\text{OI}}^{\text{crit}} \simeq 3 \times 10^5$

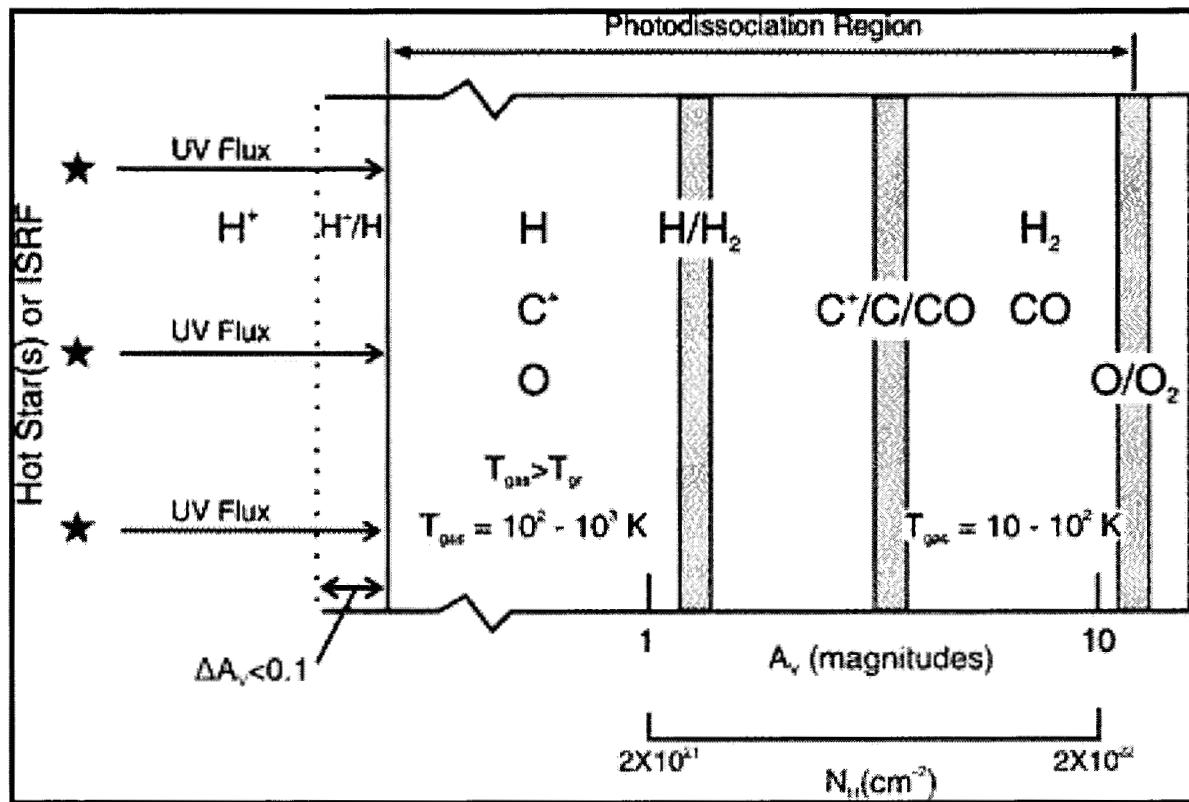
- [CII] and [OI] excited through collisions when energy deposited on the C⁺ or OI atoms is 91 and 228 K respectively .

- C⁺ or OI can collide with:

free electrons arising from ionisation of other species

free electron ejected by grains
(Small grains most important)

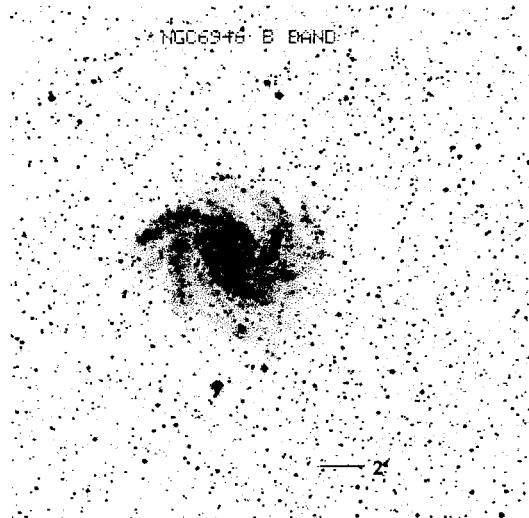
other gas ions, atoms or molecules



- FIR infrared structure lines are the main gas cooling lines
- C most abundant elements after H:
[CII] emission can go from 1 to a few percent of the FIR emission, going from less to more active systems.
- [CII] and [OI] emission comes principally from PDRs.

The observed galaxies

NGC6946



Dist. 4.5 Mpc

Face-on Scd

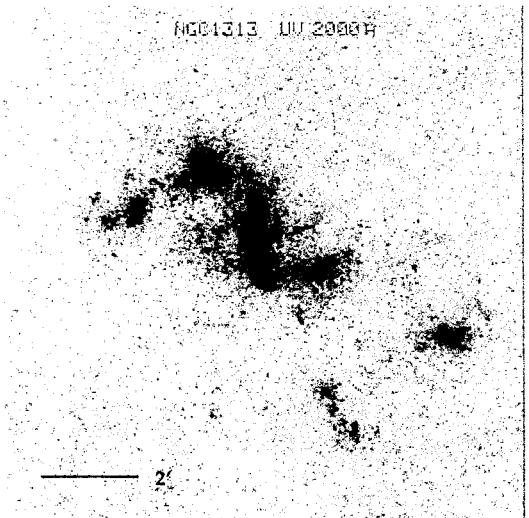
Normal metallicity

Central Starburst

CO(1-0),CO(2-1)

Visible, H α ,MIR,FIR comparable
sizes

NGC1313



Dist. 3.6 Mpc

Sd

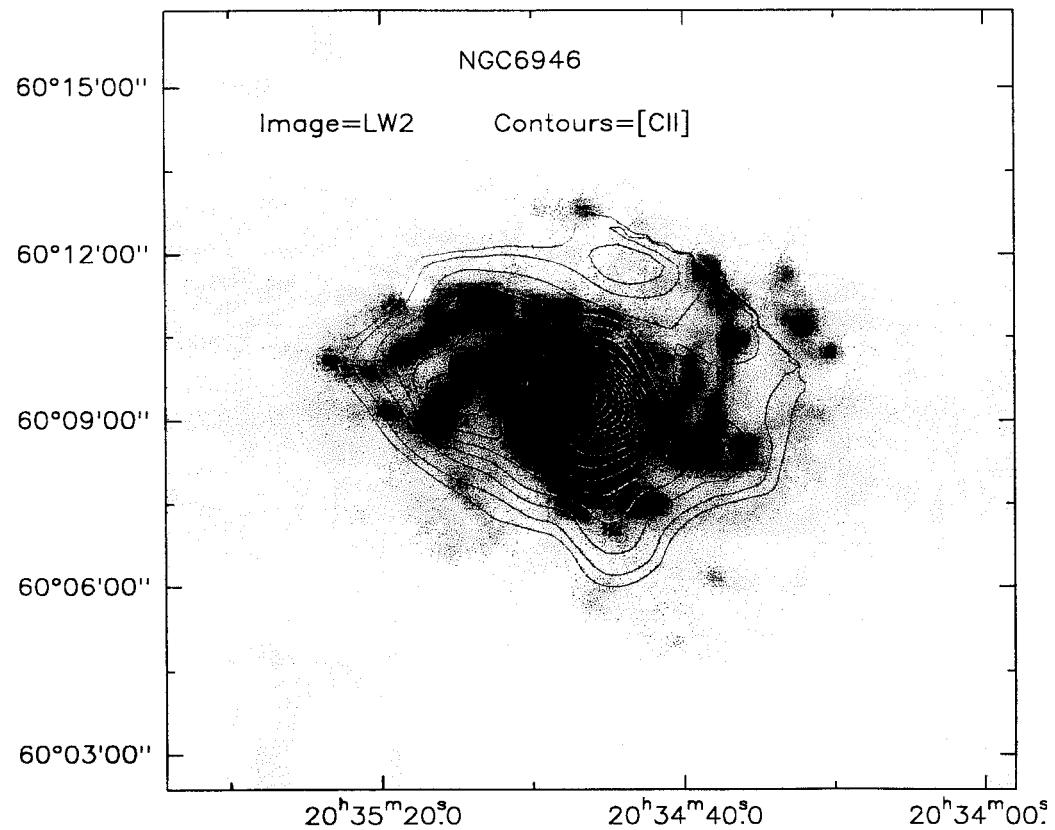
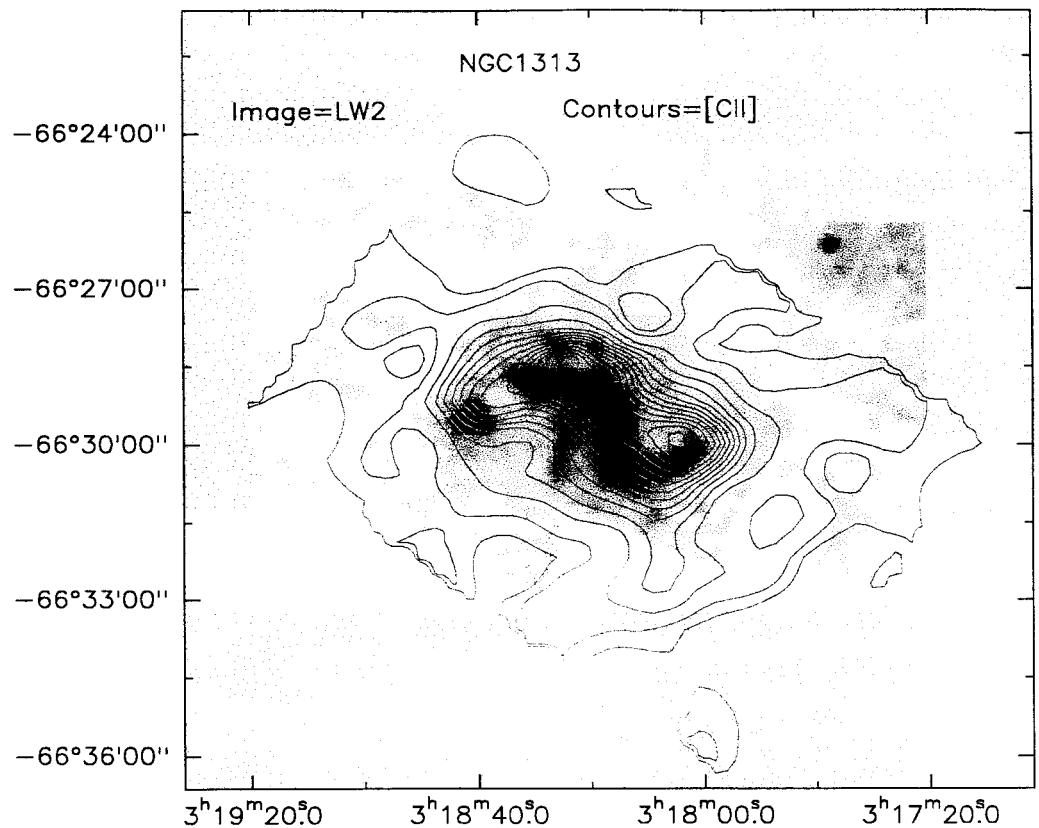
Metalliciy $\sim 1/4 Z_{\odot}$

No CO detected

UV,Visible,H I,MIR comparable
sizes

Huge HI envelop

CII emission



The [CII] foreground contribution

for NGC1313

NGC1313

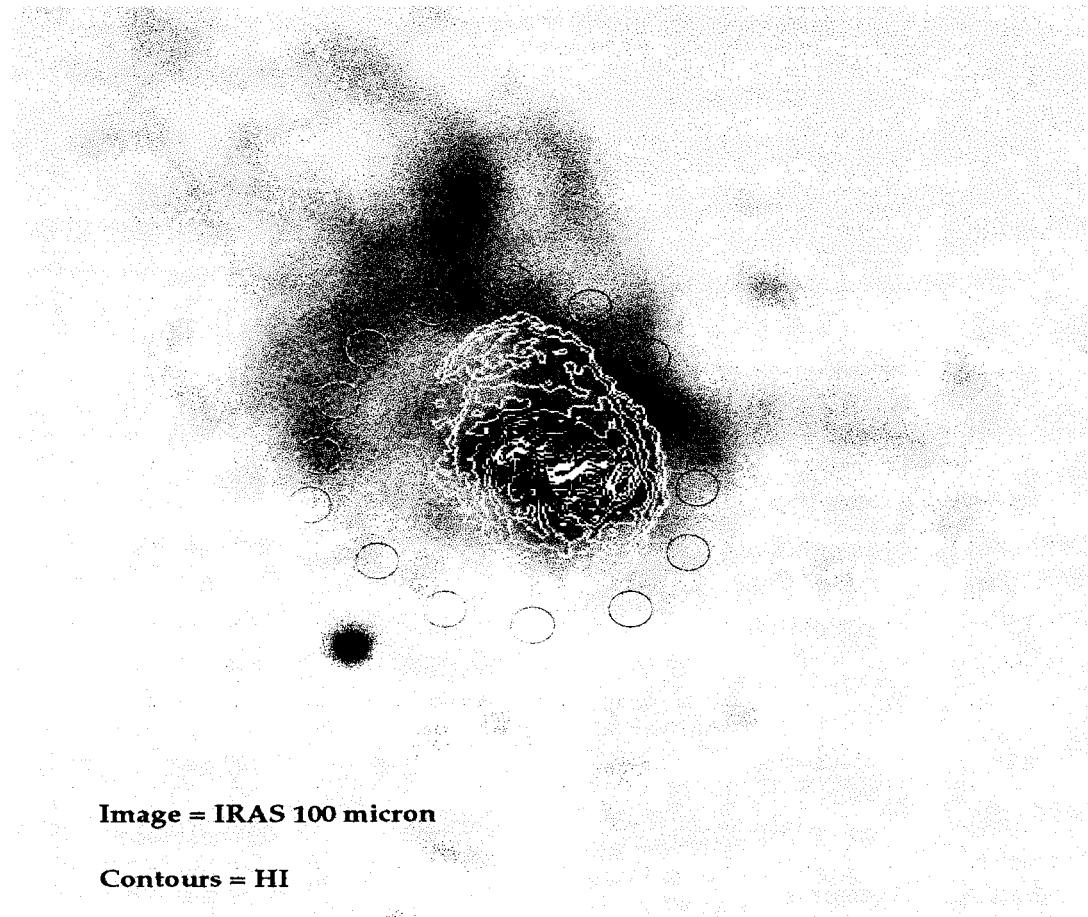


Image = IRAS 100 micron

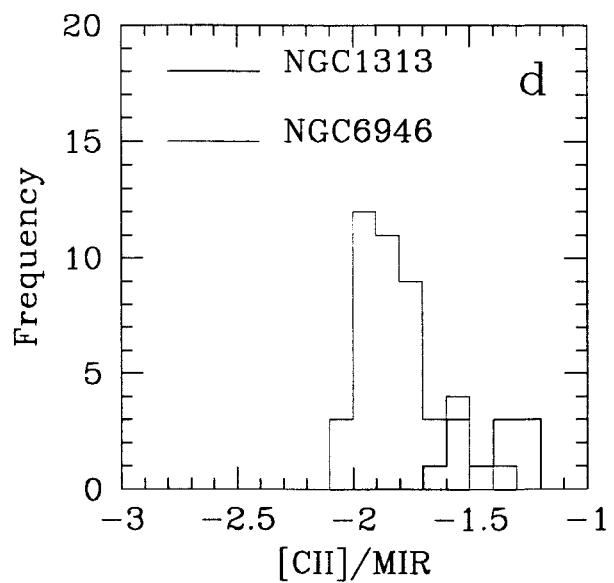
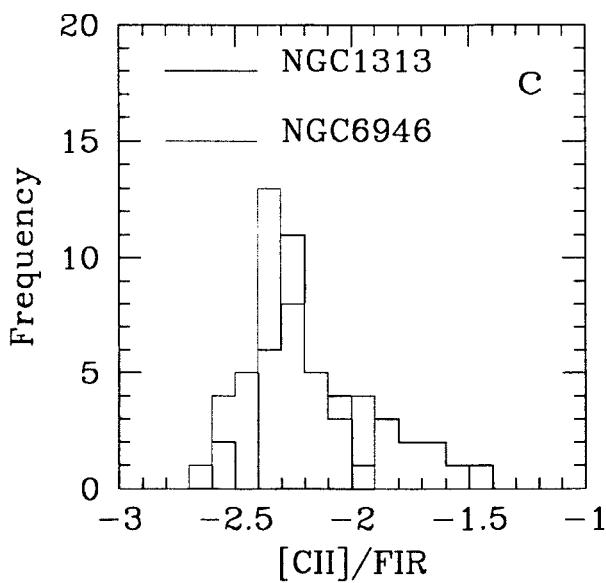
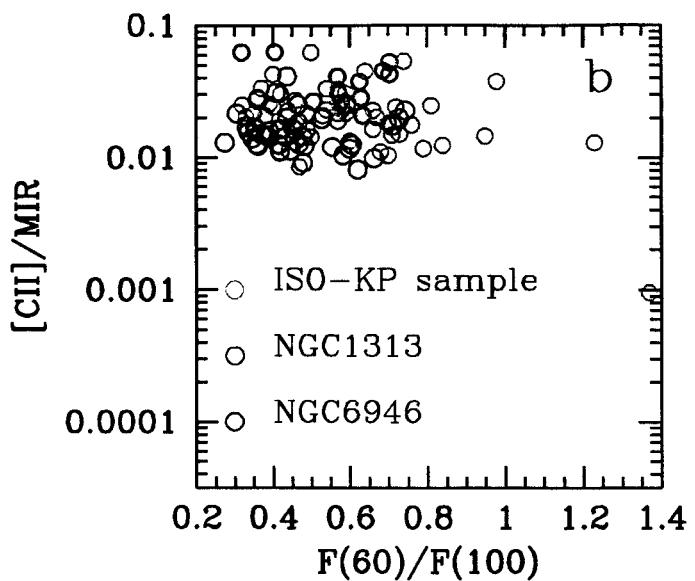
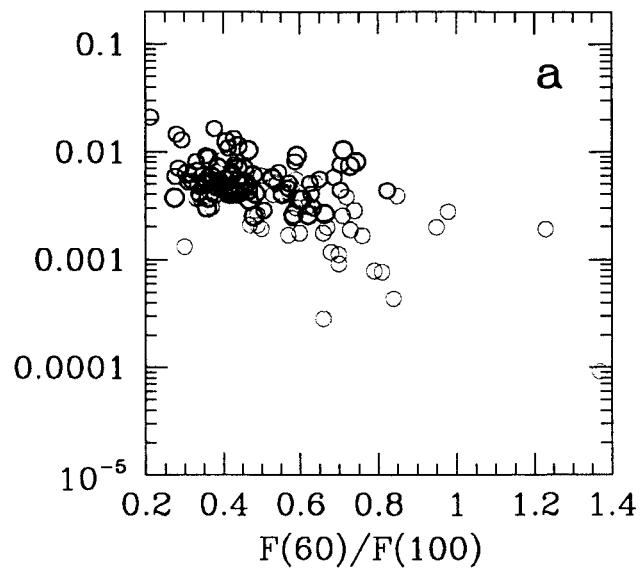
Contours = HI

Cirrus relation:

$$IC^+ (\text{erg/s/cm}^2/\text{sr}) = 0.286 \times \text{IRAS}_{100\mu m} (\text{MJy/sr})$$

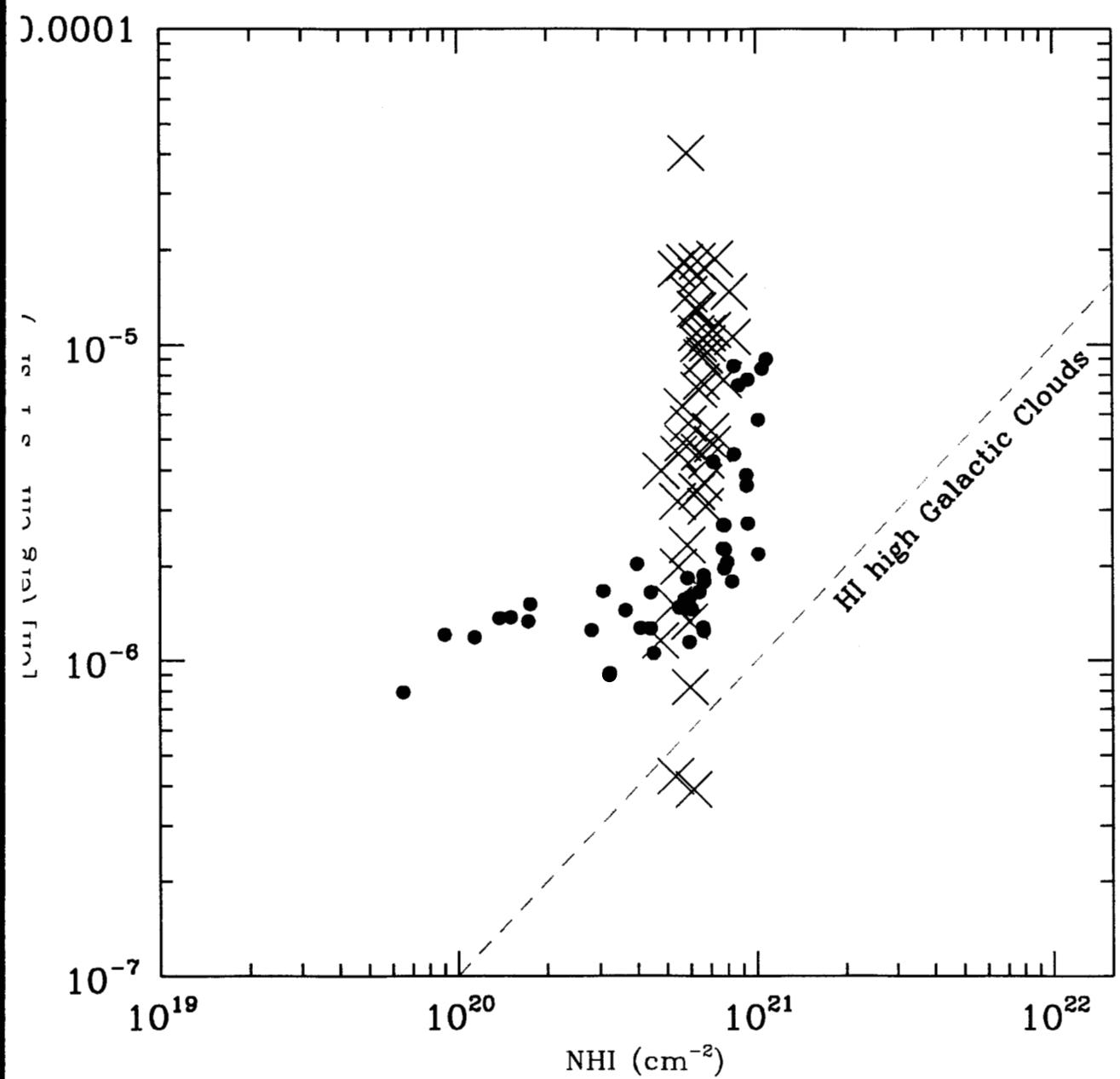
Comparison with the ISO-KP sample

L_{bol} / ...



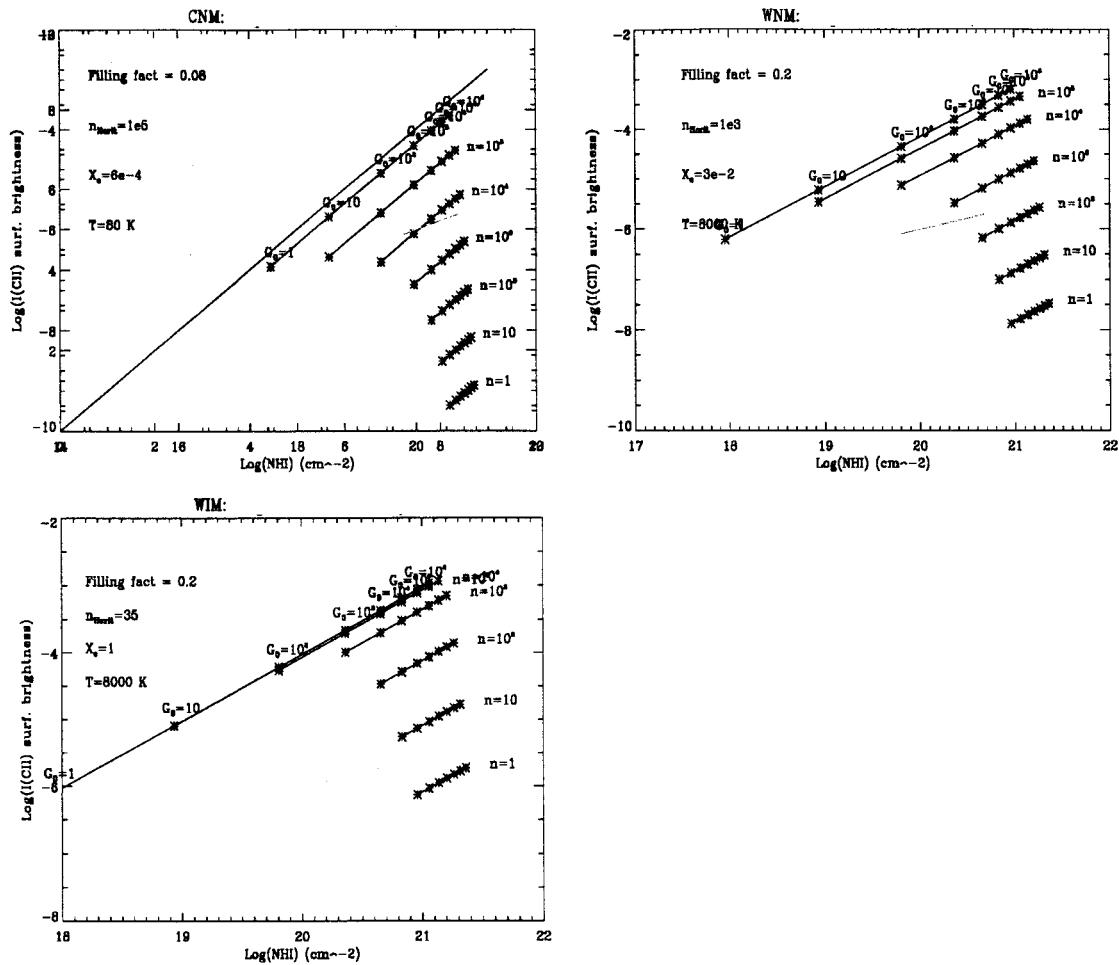
Comparison with the HI gas

NGC 6946 and NGC1313

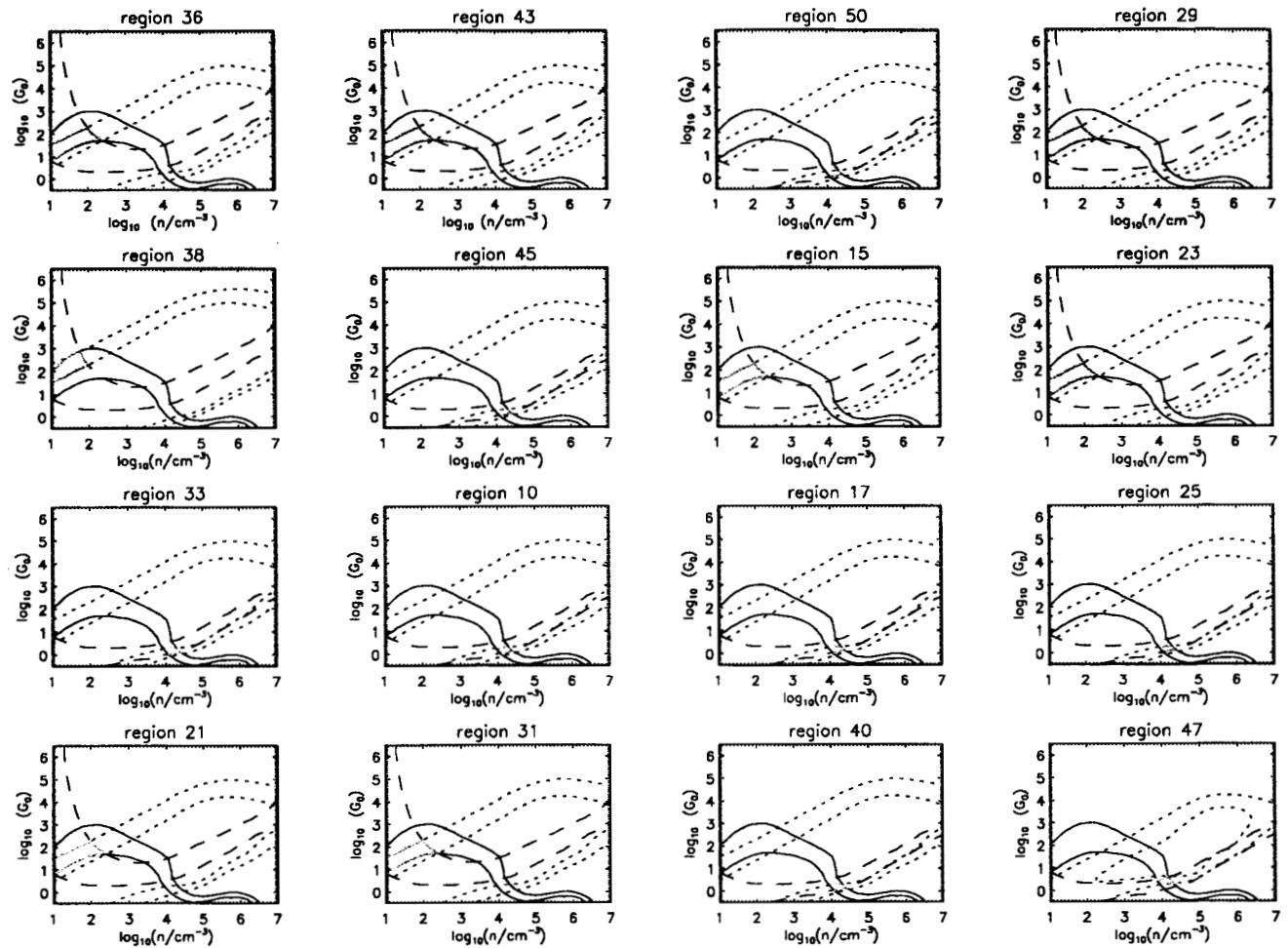


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Origin of the extended emission in NGC1313



G_0 and n_{gas} for NGC6946



Comparison with the molecular gas

NGC 6946

